

## A Collective Detection Based GPS Receiver for Small Satellites, Phase I

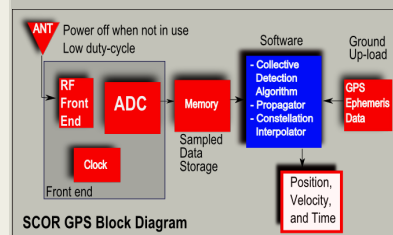
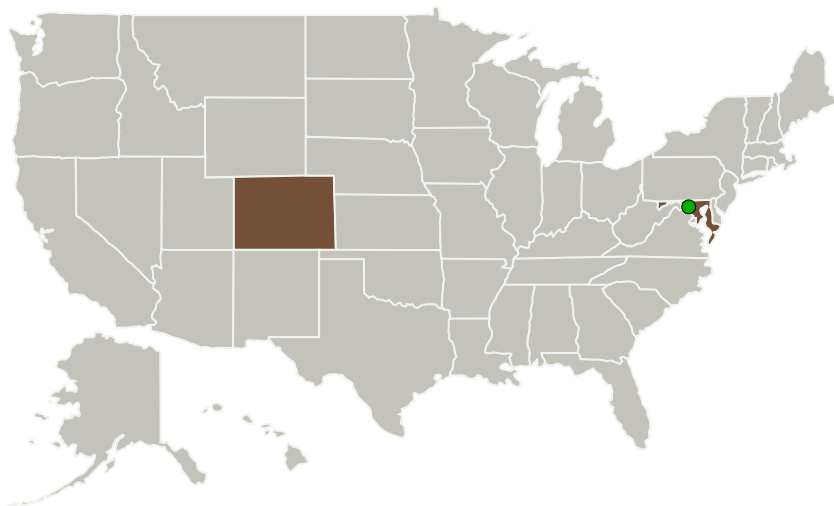
Completed Technology Project (2013 - 2014)



## Project Introduction

To solve the problem of autonomous navigation on small satellite platforms less than 20 kg, we propose to develop an onboard orbit determination receiver for small LEO satellites which lack stable Attitude Determination and Control System (ADCS), continuous GPS coverage, or ground tracking. The system is a refinement of existing spaceborne receiver technology built around a new, innovative collective detection and direct positioning algorithm developed by Dr. Penny Axelrad, a reduced set of GPS hardware, and a compact orbit propagator. The small satellite collective orbit determination receiver (SCOR) brings together efficient reference orbit representations, snapshot GPS sampling, collective detection and direct positioning, and modular orbit propagation methods, to produce an effective new approach for onboard support of small satellites. Since the collective detection algorithm does not require continuous GPS tracking to generate navigation solutions, portions of the receiver can be duty cycled to reduce power consumption between measurements. Additionally, this approach allows for satellites without pointing capabilities to obtain sufficient measurements to generate solutions by taking multiple snapshots when the spacecraft attitude is in a favorable orientation with respect to the GPS constellation.

## Primary U.S. Work Locations and Key Partners



A Collective Detection Based GPS Receiver for Small Satellites

## Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Emergent Space Technologies, Inc.	Lead Organization	Industry	Greenbelt, Maryland
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland
University of Colorado Boulder	Supporting Organization	Academia	Boulder, Colorado

## Primary U.S. Work Locations

Colorado

Maryland

## Project Transitions

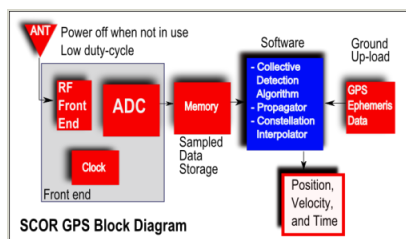
**May 2013:** Project Start

 **May 2014:** Closed out

## Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137807>)

## Images



## Project Image

A Collective Detection Based GPS Receiver for Small Satellites  
<https://techport.nasa.gov/image/136918>

## Organizational Responsibility

## Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

## Lead Organization:

Emergent Space Technologies, Inc.

## Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

## Program Director:

Jason L Kessler

## Program Manager:

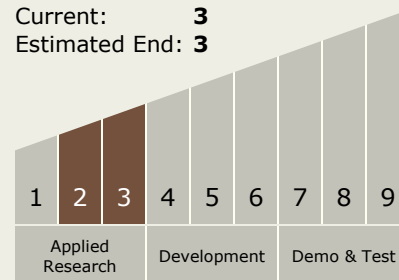
Carlos Torrez

## Principal Investigator:

William Bamford

## Technology Maturity (TRL)

Start: 2  
 Current: 3  
 Estimated End: 3



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## Technology Areas

### Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - └ TX17.4 Attitude Estimation Technologies
    - └ TX17.4.1 Onboard Attitude/Attitude Rate Estimation Algorithms

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System